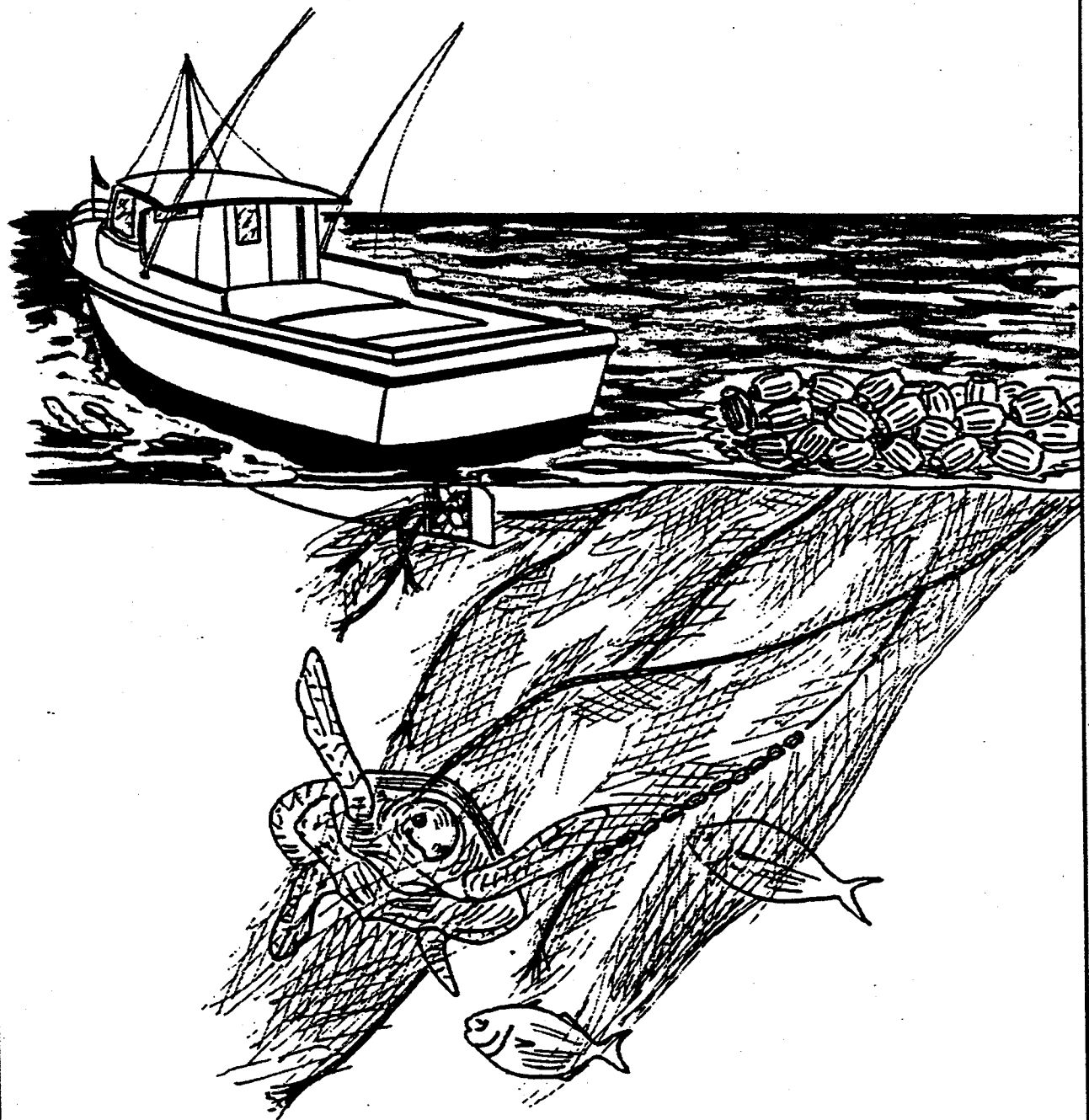


POSTER SESSION



PLASTIC POLLUTION AT SEA AND IN SEABIRDS OFF SOUTHERN AFRICA
(Poster presentation)

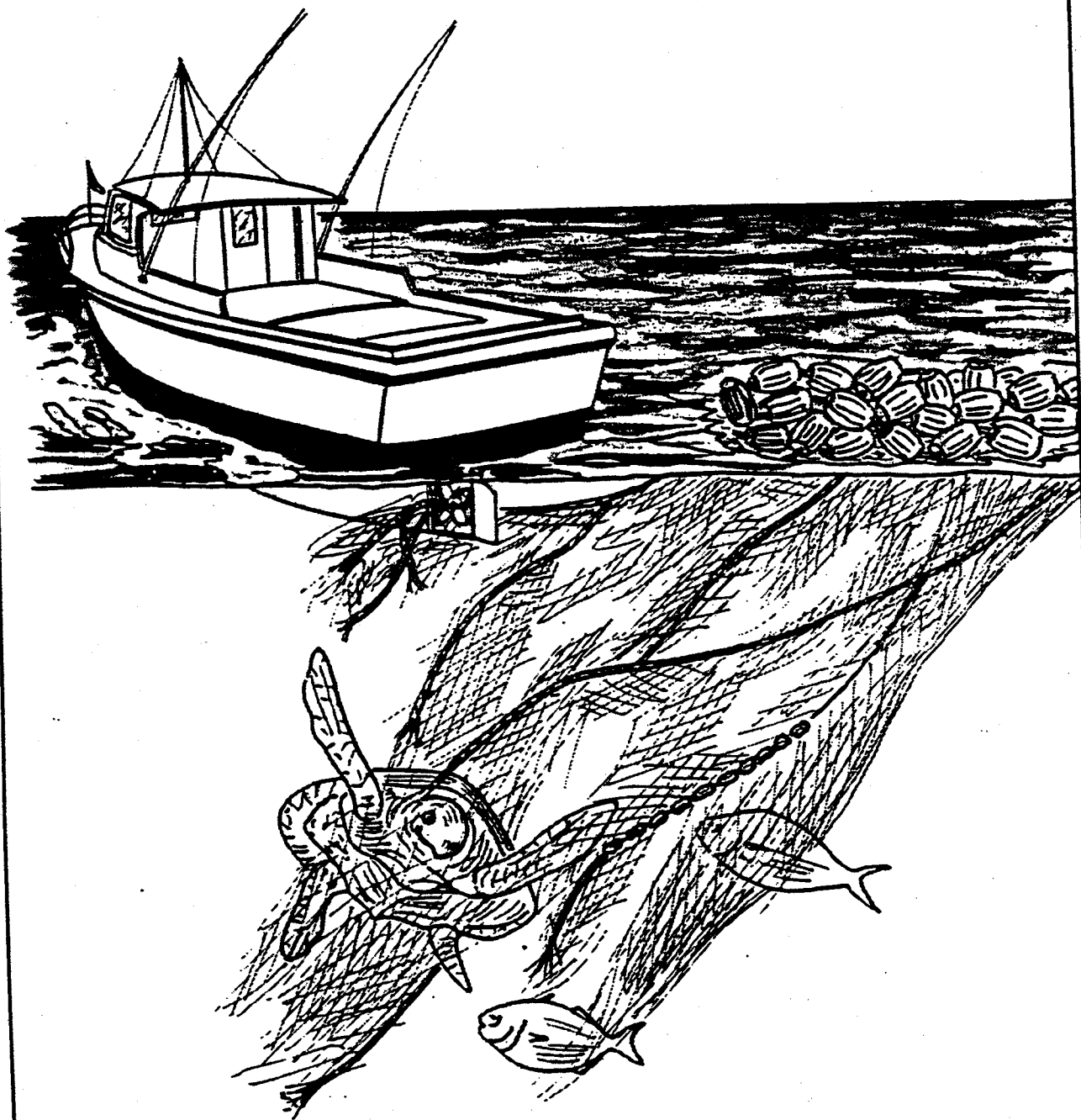
Peter G. Ryan
Percy Fitzpatrick Institute of African Ornithology
University of Cape Town
Rondebosch, 7700, South Africa

ABSTRACT

Plastic objects were first recorded from seabird stomachs in the northwest Atlantic Ocean in 1962. Since then, this phenomenon has become increasingly widespread and abundant. Recently, plastic objects have been found in the stomachs of 22 seabird species from southern Africa and the African sector of the southern ocean, including birds restricted to the pack-ice. Three species, pintado petrel, Daption capense; blue petrel, Halobaena caerulea; and great shearwater, Puffinus gravis, have plastic objects in more than 90% of stomachs. In exceptional circumstances, ingested plastics make up 0.7% of body mass and completely fill the muscular stomach (gizzard). Although much has been hypothesized, the effects of these plastic objects are unknown.

Studies are under way in attempting to determine the spatial and temporal distribution of plastic pollution at sea and on the coasts of southern Africa using neuston trawls and beach surveys. The incidence of plastic ingestion by birds is being related to diet, foraging area, and behavior. The possible effects of ingested plastic objects on seabirds are being tested by physiological and energetic experiments on captive birds which will be fed differing amounts of plastic objects and compared with controls.

WORKING GROUP REPORTS



REPORT OF THE WORKING GROUP ON MARINE DEBRIS

(Dayton L. Alverson, Chairman)

1. Review the results of the Fate and Impact of Marine Debris (FIMD) workshop sessions and determine the extent and the nature of the marine resource interaction.

The FIMD workshop provided ample evidence the debris of terrestrial and shipborne origin was widespread in the marine environment. A number of papers, mostly descriptive in character, suggests debris interacts with a wide variety of marine mammals, fish, turtles, birds, and invertebrates. The consequences and quantitative impacts of this interaction do not appear to be well understood nor documented for most observed interactions; however, substantial evidence of a qualitative character demonstrates that added mortality over those generated from natural causes is occurring for species of marine mammals, birds, fish, turtles, and shellfish. For the northern fur seals, the evidence of entanglement and increased mortality of young resulting from entanglement in large mesh trawl webbing is relatively strong, but there is a need to evaluate this hypothesis in terms of long-term availability of large mesh trawl nets and other factors such as disease. For many other species of mammals and fishes, invertebrates, seabirds, etc., evidence of death, wounds, feeding problems, etc., is apparent, but quantification of the impacts on the dynamics of impacted populations will require more study. Regardless, there is adequate data on hand to suggest that the distribution, diversity, and quantity of marine debris are increasing (in most areas) and that the consequences to marine life and human safety should not be taken lightly.

2. Determine if the workshop has missed any pertinent research efforts which address the marine debris problem and assess whether this information should be acquired to fully update the present state of knowledge.
 - a. There is a body of data within the International North Pacific Fisheries Commission documents on net design and usage in the north-eastern Pacific region. These data should be further explored to evaluate Charles W. Fowler's hypothesis that significant added mortality to young seals occurs as the result of entanglements.
 - b. Most data presented on fishing effort reflected foreign information on U.S. fishing outside of state waters. Considerably more data are available on U.S. fishing effort in the eastern Pacific. The additional data would help to broaden our understanding of possible debris-marine resource and debris-human resource interaction.

- c. Information on fouling of fishing and recreational vessels as well as other waterborne traffic should be collected to understand the full scope of impacts of marine debris.
 - d. Historical data on entanglement should be further explored in detail with regard to fur seals to determine if specific sizes of mesh can be identified which generate the greatest potential mortality.
 - e. Fishermen groups and net manufacturers should be asked to assist in identifying specific types of nets and net components which are most involved in entanglement.
 - f. Additional information is needed on seabird entanglement and ingestion of plastic materials.
 - g. Incidentally caught organisms themselves can become marine debris when discarded at sea. Further studies are needed to quantify the amount of this type of debris generated and its impacts.
3. Determine if the present state of knowledge is adequate to identify possible mitigation.

Although the present state of the problem is adequate to demonstrate that debris-marine resources interactions are occurring and that many of these interactions are generating added mortality to species of marine life as well as endangering human life in many instances, the quantitative aspects of the problem in terms of the population dynamics of the animals involved and risk to humans are unknown. Similarly the source of some debris is not clear. Finally the cost of mitigation in terms of its value to problem resolution in some instances is unclear. There are, nevertheless, possible actions that should be explored to address the most obvious and dangerous problem areas. These include:

- a. Education of the fishing community as to the extent of the problem, addressing the loss of marine mammals, fish, seabirds, sea turtles, and invertebrates and danger to human life.
- b. Consideration of regulating mesh sizes of materials (e.g., nylon) used in the wings and body of trawls. The validity of the assumption that large mesh webbing causes entanglement problems needs confirmation. Could entanglement observations result from high survival of animals encountering this gear but high mortality be associated with the more common smaller mesh? This is not likely but the possibility should not be overlooked.
- c. Regulation of the discharge of webbing and other harmful debris.
- d. Development of charts of known snags to reduce net losses by fishing vessels.

- e. Requirement for identification of fishing nets to identify source and areas lost.
 - f. Urging U.S. commitment to limit international waste disposal at sea.
 - g. Expanding public cleanup projects.
 - h. Requiring vegetable fiber hangings or escape panels on pots.
4. Determine which additional information is necessary to identify mangement actions which will alleviate the marine debris-marine resource interaction.
- a. Further explore hypothesis regarding the added mortality caused from trawl webbing and plastic bands on fur seals and other potential sources of mortality, in particular disease, which might explain declining population sizes. Consider at sea verification of entanglement and death. Also study disease factors by reinstituting pelagic high seas studies. Expand beach studies in winter to verify entanglement deaths.
 - b. Expand study of wintering areas of birds.
 - c. Study fate of lost fishing nets through experimental design studies.
 - d. Investigate life of nets and breakdown processes after loss. Also develop a catalogue to help the public identify net components and materials.
 - e. Confirm sources of major debris and expand studies of their distribution in the marine environment.
 - f. Develop standardized beach survey methodology (see manual by Theodore R. Merrell, Jr.). Also study impacts of beach transport of debris and its effect on beach survey studies.
 - g. Collect information from fishing industry on derelict fishing nets and disablement of vessels by marine litter (see Auke Bay Laboratory format).
 - h. Expand use of submersibles in studies of lost gear on the seabed.
 - i. Enlist support of Korea, Japan, and Taiwan in a study of the scope of net losses, etc., from high seas gill net fisheries for squid. Also, request aid of international organizations (Food and Agriculture Organization of the United Nations and Intergovernmental Oceanographic Commission) in determining net losses at sea.
 - j. Consider a new international scientific forum to discuss the debris problem and other natural resource and environmental problems in the North Pacific region.

- k. Evaluate the scope of the entanglement problem for marine mammals in other major world trawling areas. Do the same problems exist?
- l. Considerations need to be given to the potential benefits of marine debris. There is evidence that some marine birds and fish benefit from marine debris.
- m. Information should be obtained on the extent to which Asian fisheries contribute to floating and beach debris in the Bering Sea and the North Pacific.
- n. Investigate current use and needs of plastic bands and potential design alterations which could alleviate associated problems.

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REPORT OF THE WORKING GROUP ON IMPACTS OF DEBRIS ON RESOURCES

(Douglas G. Chapman, Chairman)

After reviewing some of the questions raised in background sessions, this group decided to deal first with general aspects and then to consider problems on a resource or species basis. For each of these, the Working Group attempted to: (1) define the problem and the problem material, (2) suggest information needed, (3) provide recommendations to obtain the information or to begin mitigation of the problem, and (4) note any other relevant points.

1. General.

a. Information needed.

- (1) What is the fate of different gear types in different locales (and similar information for other debris, particularly bands)?
- (2) How long are the different types of debris likely to have an impact, that is, cause entanglement?
- (3) What are the rates of gear loss for fisheries, for which ghost fishing seems to be a problem?

b. Recommendations relevant to mitigation.

- (1) Require net identification.
- (2) Develop a reference collection of debris, particularly nets.
- (3) Reduce sources of debris by educational programs.
- (4) Evaluate the costs and benefits of removal of debris from beaches on a periodic basis.

c. Other comments.

- (1) To assist in scientific research to be undertaken on marine debris problems or mitigation, it is desirable to have clear definitions of the problem.
- (2) It needs to be recognized that marine debris can have positive benefits and these should be recognized and, if possible, assessed.

2. Fur seals.

a. Problem.

For fur seals, it is clear that the problem of marine debris centers on (i) trawl net fragments and (ii) bands, usually of plastic. Seals entangled in trawl net fragments are impeded in swimming and diving and hence, have higher energy costs and lower feeding efficiency. They may also cause the seals to be more subject to predation. Bands around the seals' necks can cause lesions and ultimately death from suffocation.

b. Information needed.

- (1) Confirmation of level of mortality that to date has been estimated by indirect methods.
- (2) Studies as to whether fur seals become entangled with equal probability in netting of different mesh sizes.
- (3) Determination as to whether the distribution of net debris at sea is the same (in regard to size, type, etc.) as is found on the beaches.
- (4) Theoretical work or experimental studies should be carried out to relate drag of netting, etc., on entangled seals to their rate of survival.

c. Recommendations to obtain information or for mitigation.

- (1) Radio tag and monitor entangled seals.
- (2) Set up experiments utilizing marked net debris near rookery islands.
- (3) Carry out additional beach and sea surveys; it may be necessary to survey at sea using several methods.
- (4) Explore the possibility of obtaining insight into the problem or into mitigation through comparison of different pinnipeds.

d. Other points.

It was emphasized that although marine debris (trawl net fragments and bands) is at the moment the most plausible explanation of the recent fur seal population decline, other possible explanatory hypotheses should continue to be investigated.

3. Fisheries.

a. Problem.

Marine debris impacts fisheries through possible problems of vessel operations and through mortality on commercial fish of interest to

the fishery. Lost or discarded gill nets or gill net fragments appear to be the primary problem for both of these impacts.

b. Information needed.

- (1) Quantitative information is needed on the types of problems caused by net entanglement on fishing vessel operations as well as their frequency.
- (2) Information is needed on the level of mortality of commercial fish stocks in ghost fishing gear.

c. Recommendations.

- (1) Seek information from and cooperation with fishermen on the effects of marine debris on fishing vessel operations.
- (2) If information on the amounts of ghost gear at sea and the longevity of impact were to become available, it would be possible to incorporate the mortality due to ghost gear into population dynamics models and thus, determine full impact.
- (3) Studies should be undertaken on the costs and benefits as well as the possible options in making part or all of the net of biodegradable material.

4. Monk seals.

a. Problem.

Trawl net fragments are those debris items that have been found on monk seals and are perceived to be the main source of possible mortality. The rate of entanglement and, hence, of mortality is unknown but any loss is serious for this endangered species.

b. Information needs.

The information needs are much the same as those for the fur seal though it will be more difficult and less appropriate to carry out any experimental work on animals of this endangered species.

c. Recommendations.

- (1) Carry out entanglement studies on captive animals.
- (2) Clean up net debris on the beaches and in the lagoons of the islands and atolls inhabited by monk seals. This should be done on a continuing basis.
- (3) Continue to monitor populations to determine the number of pups born and other population dynamics parameters but also, to determine the number of entangled seals and as possible, to remove the entangling material.

5. Birds.

a. Problem.

Marine debris impacts marine birds in two different ways, through entanglement and through ingestion. In regard to entanglement, lost and discarded gill net and gill net fragments are the prime cause, though it is believed that active fisheries represent a much more serious problem than ghost fishing. Plastic pellets are implicated as the cause of the ingestion problem.

b. Information needs.

- (1) Population dynamics studies are needed of two or three species of birds that are most seriously involved in debris entanglement.
- (2) The impacts of ingestion are not well understood and physiological studies and experiments are needed to determine such impacts.
- (3) Ingestion of plastic pellets may involve a hydrocarbon contamination problem and studies need to be made to determine if this is so and what impact it might have.

c. Recommendations.

- (1) Whatever steps are possible should be taken to seek elimination of dumping of effluent from manufacturing plants.
- (2) As feasible, ocean surveys should be carried out to determine the level, distribution, and if possible, the source of plastic pellets. It was suggested that directed surveys are unlikely to be feasible but it may be possible to use platforms of opportunity.

6. Marine turtles.

a. Problem.

Although entanglement has been observed, ingestion of various types of marine debris, particularly plastic, seems to be the more serious potential problem.

b. Information needed.

- (1) Similar to birds, the effects of plastic ingestion and the possibility of a hydrocarbon contamination effect are unclear. Hence studies are needed to determine if such effects exist and what their mortality implications would be at the individual level.
- (2) Information is needed on the impact of such effects at the population level.

c. Recommendations.

- (1) The stranding network in which stranded turtles are collected needs to be expanded and steps taken to assure that all stranded turtles are examined, as far as this is possible.
- (2) Collection of turtles should be made for stomach analyses. Again this is most likely to be feasible from platforms of opportunity.

REPORT OF THE WORKING GROUP ON THE FATE OF MARINE DEBRIS

(James D. Schumacher, Chairman)

1. Research needs.

We believe that the extent, nature, and fate of debris are not well defined, although debris is clearly a problem throughout the world oceans. It is essential that research activities receive close international coordination.

a. More information is required on the quantity, type, distribution, and change with time of the amount of debris. The following strategies could address the problem of debris:

- (1) Develop sampling devices for marine debris such as neuston nets with grappling hooks, and perhaps moored automatic collectors.
 - (2) Conduct beach surveys: expand present efforts in time and space, mark or remove debris so that the rate of accumulation can be estimated, and standardize reports from all nations.
 - (3) Do site-specific studies in the following environments:
 - (a) The eastern Bering Sea (Pribilof Islands) where there are low currents, large mammal populations, and extensive fishing efforts.
 - (b) Hawaiian Island waters, where there are endangered species and existing programs (monk seals) which would allow comparisons between beached and at-sea material.
 - (c) North-south sections along longitudes in the eastern and western Pacific (i.e., across convergence features and upstream and downstream).
 - (4) Conduct "ship of opportunity" surveys from the National Oceanic and Atmospheric Administration and other research vessels.
- b. Examine the timing and rates of change of the threat potential of debris. How does debris change mechanically (e.g., nets become balls), chemically (buoyancy effects), and biologically (plant growth). Once beached, is debris no longer a problem; can it be returned to sea or be a problem on the beach itself? To what extent is benthic debris a threat to animals?

- c. Investigate the mechanisms of entanglement, ingestion, or wounding of individuals with marine debris. Obtain better estimates of the rates of death at sea caused by derelict gear and other debris. Evaluate the impact of entanglement and ingestion of marine debris on animal populations.
 - d. Examine the potential impact of demersal gill nets on marine fauna.
 - e. Examine historical records of monthly mean atmospheric pressure to determine the variability of surface currents. Evaluate the utility of using mean monthly atmospheric pressures as an index of the drift of marine debris.
 - f. Determine how activities will be coordinated to facilitate the exchange of ideas, data, and techniques amongst the international community.
2. The present state of knowledge suggests the following mitigating actions:
- a. Enhance communications to:
 - (1) Change human attitudes toward the environment--the sea, even at its greatest depths, and beaches are not endless garbage pits. Encourage and facilitate the proper disposal of debris.
 - (2) Provide incentives to fishermen to cut packing bands and to return net fragments (e.g., nets continue to harvest fish, foul boats, and harm marine mammals and birds--The Oregon Experience).
 - b. Conduct materials research:
 - (1) Print "please cut" on bands, develop snap-off bands, and bands with biodegradable weak links.
 - (2) Can materials that may potentially become marine debris be made degradable?
 - (3) Can trawl net material be made negatively buoyant?
 - c. Continue to remove and quantify debris from monk seal habitat.

REPORT OF THE WORKING GROUP ON MANAGEMENT NEEDS

(Charles Karnella, Chairman)

The Working Group on Management Needs (Group), while recognizing that further research is indicated to quantify certain aspects of entanglement in and ingestion of debris, strongly believes that the data presented also indicate that a variety of management actions need be promptly undertaken as well. In recognition of this fact, the Group urges the National Oceanic and Atmospheric Administration and other relevant agencies take the following steps:

1. Program management.

The immediate needs in this area are that:

- a. A person of appropriate stature with the National Marine Fisheries Service be appointed program coordinator; and
- b. A mechanism be established whereby overall program progress can be effectively reviewed at periodic intervals.

2. Public information and education.

Recognizing that greater benefits are likely to be realized as a result of positive rather than negative incentives, Group participants urged that significant emphasis be placed upon public information and education and that steps specifically be taken to:

- a. Work with fisheries organizations and the fishery management councils to develop and carry out comprehensive information and education programs for foreign fishermen, working within the exclusive economic zone, and U.S. fishermen;
- b. Work with appropriate national and international organizations to undertake cooperative comprehensive information and education programs; and
- c. Work with relevant industries, such as has been done with elements of the plastics industry, on public education programs.

3. Technology.

While recognizing the actions already taken by the National Marine Fisheries Service to establish a center for purposes of identifying debris and photographs of debris, the Group concluded that further needs indicated in this area are:

- a. A reference catalogue of netting materials be developed;
- b. Actions be taken to develop and implement improved or alternative methods of fishing that will diminish the likelihood of gear loss;
- c. Use be made of degradable materials and other gear alterations;
- d. Efforts be undertaken to develop economically attractive methods for recycling plastics retained at sea;
- e. Economical and effective systems be developed to mark gear through color coding or other means for retrieval and identification of source;
- f. Systems be developed to facilitate and simplify means of retaining damaged gear onboard for onshore disposal; and
- g. Modifications to plastic packing bands be developed to reduce entanglement problems.

4. Debris cleanup.

Group participants concluded that immediate steps to remove existing debris from the environment are clearly needed and concentrated efforts should be directed to reducing the rate at which new debris is deposited. The management steps recommended are:

- a. To undertake cleanup programs to remove existing debris from shore areas and the water column;
- b. To assign priority to areas where the density of debris is such that it affects endangered, threatened, or commercially valuable species;
- c. To require that all potentially harmful debris be retained onboard vessels until proper disposal is possible;
- d. To encourage the removal of debris from the environment and prevent the discarding of additional debris, positive incentives such as financial rewards for the return of discarded netting material should be considered as should possible negative incentives; and
- e. To take such actions as may be necessary to assure the proper disposal of unwanted materials in a nonharmful manner.

5. Regulations.

Group participants, having considered presentations on the legal issues involved, concluded that the current state of our knowledge of the problems warrants immediate initiation of certain regulatory actions and exploration of a variety of other measures. The recommended steps are that:

- a. Appropriate use be made of the several existing treaties, laws, and programs, including amendments where necessary, so as to minimize and as possible stop the deposition of harmful debris;
 - b. Other countries be requested to examine their domestic authorities for similar purposes as in "a" above.
 - c. Gear damage compensation programs be reviewed to lessen unnecessary contributions to lost net debris;
 - d. The Secretary of Commerce review his rulemaking authority under the Fishermen's Protective Act to help reduce gear loss;
 - e. The Magnuson Fishery Conservation and Management Act be reviewed to determine whether additional steps can be taken under its authority to reduce gear disposal at sea;
 - f. Consideration be given to amending the Magnuson Fishery Conservation and Management Act to include provisions for U.S. fishermen on gear disposal at sea and the reporting of abandoned gear comparable to those applicable to foreign fishermen;
 - g. Fishermen be advised that the purposeful disposal of fishing gear in the territorial sea is prohibited under the Clean Water Act;
 - h. The U.S. ratify optional Annex V of the Convention for the Prevention of Pollution from Ships and encourage other fishing nations to become signatories;
 - i. The U.S. consider "regional seas" agreements under the United Nations Environment Programs for waters adjacent to the U.S.;
 - j. Existing U.S. treaties, laws, and relevant programs (including those in "a" above) be reviewed to determine if they can be used to reduce debris, other than fishing debris, from land and water sources; and
 - k. Consideration be given to the development of a broad range of positive (financial) and negative (regulatory) incentives to reduce the deposition of debris in the marine environment.
6. Identification of problems and impacts.

The Group concluded that:

- a. Existing data on the impacts on marine organisms of nonbiodegradable debris from foreign and domestic fisheries be analyzed to document the magnitude of this problem;
- b. The rates of accumulation and disappearance of synthetic debris on selected beaches be monitored;
- c. Information developed by stranding networks be monitored as an index of levels of entanglement;

- d. A standardized program to monitor debris ingestion and entanglement on a regular long-term basis be developed and implemented;
- e. A reporting program to monitor entanglement of vessels in lost or discarded fishing gear be undertaken; and
- f. The impact of lost or discarded fishing gear and other marine debris on marine mammals, birds, turtles, fish, and human beings be monitored;
- g. Assess on a continuing basis the type and quantity of debris loss in domestic and foreign fisheries, with emphasis on trawl and pelagic drift gill net fisheries of the North Pacific; and
- h. Identify problems and impacts on certain fisheries; programs related to debris entanglement should be coordinated with programs related to incidental take.

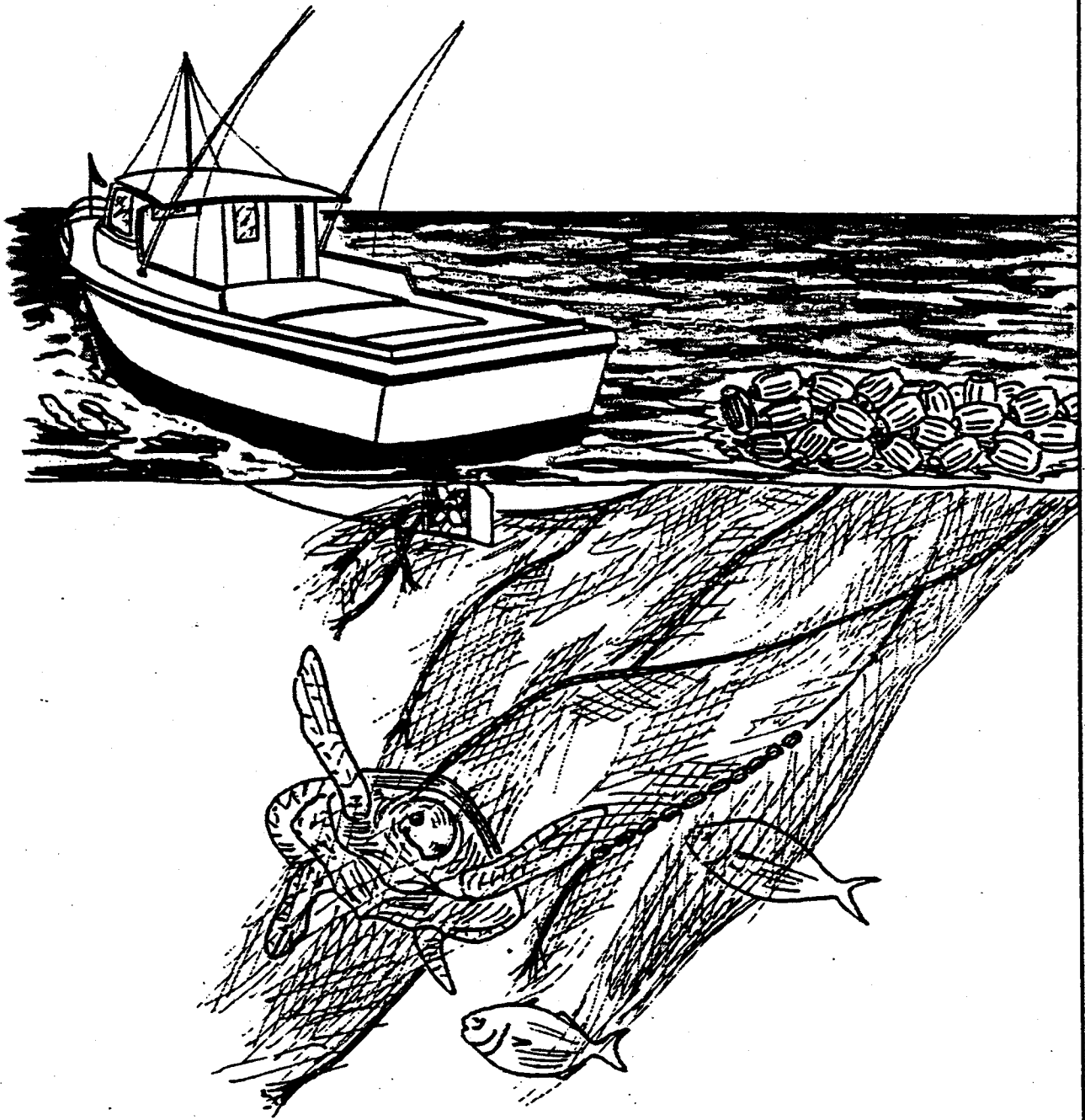
7. Disentanglement.

The Group believes that known methods for disentangling ships and animals should be widely disseminated to those likely to be in need and that efforts should be devoted to developing and publicizing improved techniques for gill net disentanglement.

8. Workshop results.

The Working Groups recommend that the papers, recommendations, and workshop proceedings be forwarded to other responsible agencies including the Departments of Commerce, Transportation, Interior, Defense, State, the Council on Environmental Quality, the Environmental Protection Agency, and appropriate congressional committees with a request that they address these issues.

APPENDICES



APPENDIX A

STEERING GROUP

Jim H. Branson, North Pacific Fishery Management Council
Douglas G. Chapman, Marine Mammal Commission
Jack R. Davidson, Sea Grant College Programs, University of Hawaii
Charles W. Fowler, National Marine Fisheries Service
Richard S. Shomura, National Marine Fisheries Service
Fredrick Wathne, National Marine Fisheries Service

APPENDIX B

AGENDA

1. Opening of the Workshop
2. Workshop Sessions
 - a. Legal framework
 - b. Session I - Source and quantification of marine debris
 - c. Session II - Impacts of debris on resources
 - d. Session III - Fate of marine debris
 - e. Working Group Meetings
3. Special Session - Identifying management needs
4. Film showing
5. Plenary Session
6. Closing of the Workshop

APPENDIX C

LIST OF PARTICIPANTS

Agard, Mr. Louis
55 South Kukui Street, D-404
Honolulu, HI 96813

Alverson, Dr. Dayton L.
Natural Resources Consultants
4055 21st Avenue West
Seattle, WA 98199

Amano, Dr. Ryohei
Faculty of Marine Science and
Technology
Tokai University
1-20-3 Orido, Shimizu
Shizuoka, Japan 424

Angelovic, Dr. Joseph W.
Deputy Assistant Administrator
for Science and Technology
National Marine Fisheries Service
3300 Whitehaven Street, NW, #410
Washington, D.C. 20235

Aron, Dr. William
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Bailey, Mr. Michael
Greenpeace Hawaii
19 Niolopa Place
Honolulu, HI 96817

Baker, Mr. C. Scott
Department of Zoology
University of Hawaii
Edmondson Hall
2538 The Mall
Honolulu, HI 96822

Balazs, Mr. George H.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Barrett, Dr. Izadore
Southwest Fisheries Center
National Marine Fisheries Service
P. O. Box 271
La Jolla, CA 92038

Bengtson, Mr. John L.
National Marine Mammal Laboratory
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Benton, Mr. David
Nunam Kitlutsisti
1069 W. 6th Avenue
Anchorage, AK 99501

Braham, Dr. Howard W.
National Marine Mammal Laboratory
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Britten, Ms. Barbara H.
American Cetacean Society
1200 S. Arlington Ridge Rd., #410
Arlington, VA 22202

Burr, Mr. Timothy
Pacific Naval Facilities
Engineering Command
Code 24B: TB
Pearl Harbor, HI 96860

Calkins, Dr. Donald G.
Alaska Department of
Fish and Game
333 Raspberry Road
Anchorage, AK 99502

Carothers, Mr. Paul E.
1121 Arlington Boulevard,
#339
Arlington, VA 22209

Carr, Dr. H. Arnold
Division of Marine Fisheries
The Commonwealth of Massachusetts
449 Route 6A
E. Sandwich, MA 02537

Chang, Mr. Randolph K. C.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Chapman, Dr. Douglas G.
Marine Mammal Commission
c/o Center for Quantitative
Science - HR 20
University of Washington
Seattle, WA 98195

Chen, Dr. T. F.
Council for Agriculture
Executive Yuan, 37 Nanhai Road
Taipei, Taiwan 107
Republic of China

Consiglieri, Lt. Lewis D.
Western Pacific Program Office
Southwest Region
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Dahlberg, Dr. Michael L.
Auke Bay Laboratory
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
P. O. Box 210155
Auke Bay, AK 99821

Davidson, Dr. Jack R.
Sea Grant College Program
University of Hawaii
Marine Science Bldg., #220
1000 Pope Road
Honolulu, HI 96822

Day, Dr. Robert H.
Institute of Marine Science
University of Alaska
200 O'Neill Building
Fairbanks, AK 99701

DeLong, Dr. Robert
National Marine Mammal Laboratory
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

DeMaster, Dr. Douglas P.
Southwest Fisheries Center
National Marine Fisheries Service
P. O. Box 271
La Jolla, CA 92038

Dentler, Mr. John L.
U.S. House of Representatives
House Committee on Merchant
Marine and Fisheries
HOB #2 Room 545
Washington, D.C. 20515

Dozier, Mr. William
14th Coast Guard District
300 Ala Moana Boulevard
P. O. Box 50229
Honolulu, HI 96850

Eckert, Mr. David
Division of Aquatic
Resources, DLNR
1151 Punchbowl Street
Honolulu, HI 96813

Fefer, Mr. Stewart
U.S. Fish and Wildlife Service
P. O. Box 50167
Honolulu, HI 96850

Fowler, Dr. Charles W.
National Marine Mammal Laboratory
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Fredin, Mr. R. A.
Natural Resources Consultants
2328 NE, 104th Street
Seattle, WA 98125

Frizell,
Internati
Advisor
164 High
Sussex,

Galt, Mr
Ocean As
National
7600 Sa
BIN C15
Seattle

Gerrode
Southw
Hono
Nation
P. O.
Honolt

Gibson
Frien
1069
Ancho

Gilb
Wild
Univ
Oron

Gilb
Sou
B
Nat
P.
Hon

Gi
U.
18
W

G
P

Frizell, Mr. John
International Environmental
Advisors
164 High Street, LEWES
Sussex, United Kingdom

Galt, Mr. J. A.
Ocean Assessments Division
National Ocean Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Gerrodette, Dr. Timothy
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Gibson, Ms. Margie Ann
Friends of the Earth
1069 West 6th Avenue
Anchorage, AK 99501

Gilbert, Dr. James R.
Wildlife Department
University of Maine
Orono, ME 04469

Gilmartin, Mr. William G.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Gilmore, Mr. Robert
U.S. Fish and Wildlife Service
18th and C Streets
Washington, D.C. 20240

Goldman, Mr. Jeff
Pacific Marine Research
Foundation
222 La Plata
Santa Barbara, CA 93109

Gong, Dr. Yeong
Deep-Sea Fisheries Research
Division
Fisheries Research and
Development Agency
#16, 2nd-ga, Namhang-dong,
Yeongdo-gu
Busan 606, Republic of Korea

Gooding, Mr. Reginald M.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu HI 96812

Goodman, Dr. Dan
Department of Fisheries
and Oceans
200 Kent Street
Ottawa, Ontario, Canada KIA 0E6

Gosliner, Mr. Michael
Office of General Counsel
National Oceanic and Atmospheric
Administration
3300 Whitehaven Street
Washington, DC 20235

Grovhoug, Mr. Jeff
220 Aiokoa Street
Kailua, HI 96734

Hamm, Mr. David C.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Harrison, Mr. Craig S.
ICBP Seabird Committee
Representative
46-024 Puulena Street, #614
Kaneohe, HI 96744

Henderson, Mr. John R.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Heneman, Mr. Burr
Marine Mammal Commission
35 Horseshoe Hill Road,
Star Route
Bolinas, CA 94924

Higashi, Mr. Glenn R.
Fisheries Development Unit
Division of Aquatic Resources,
DLNR
1151 Punchbowl Street, #330
Honolulu, HI 96813

High, Mr. William L.
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Ho, Ms. Jo-Anne
Fisheries Development Unit
Division of Aquatic
Resources, DLNR
1151 Punchbowl Street, #330
Honolulu, HI 96813

Honda, Mr. Victor A.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Hu, Ms. Darcy
U.S. Fish and Wildlife
Service
P. O. Box 50167
Honolulu, HI 96850

Humphreys, Mr. Robert L. Jr.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Ikehara, Mr. Walter N.
Division of Aquatic
Resources, DLNR
1151 Punchbowl Street
Honolulu, HI 96813

Iversen, Mr. Robert T. B.
Western Pacific Program Office
Southwest Region
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Jaildagian, Mr. Bruce
Greenpeace
P.O. Box 50489
Jacksonville, FL 32240

Johanos, Ms. Thea
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Jones, Dr. Linda L.
National Marine Mammal Laboratory
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Kaiser, Mr. Steven R.
Sea Life Park
Makapuu Point
Waimanalo, HI 96795

Kanenaka, Mr. Brian
Division of Aquatic
Resources, DLNR
1151 Punchbowl Street
Honolulu, HI 96813

Karnella, Dr. Charles
Office of Protected Species and
Habitat Conservation, F/M412
National Marine Fisheries Service
Washington, D.C. 20235

Katekaru, Mr. Alvin
Division of Aquatic
Resources, DLNR
1151 Punchbowl Street
Honolulu, HI 96813

Kaufman, Mr. Greg
Pacific Whale Foundation
Suite 302, Azeka Place
P. O. Box 1038
Kihei, Maui, HI 96753

Kawamoto, Mr. Paul
Division of Aquatic
Resources, DLNR
1151 Punchbowl Street
Honolulu, HI 96813

Kim, Mr. Han-Mo
Alaska Office Division
Korean Deep Sea Fishery
Association
13439 Karen Street
Anchorage, AK 99515

Kramer, Mr. Glenn
P. O. Box 10508
Bainbridge Island, WA 98110

Lecky, Mr. James H.
Southwest Region
National Marine Fisheries Service
300 S. Ferry Street, Rm. 2011
Terminal Island, CA 90732

Lenarz, Dr. William H.
Southwest Fisheries Center
Tiburon Laboratory
National Marine Fisheries Service
3150 Paradise Drive
Tiburon, CA 94920

Loughlin, Dr. Thomas
National Marine Mammal Laboratory
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Low, Dr. Loh-Lee
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Luginbuhl, Mr. Chris
ICES
Box 263
Ellington, CT 06029

Magaard, Dr. Lorenz
Department of Oceanography
University of Hawaii
Marine Science Bldg., #418
1000 Pope Road
Honolulu, HI 96822

Marmelstein, Dr. Allan
U.S. Fish and Wildlife Service
P. O. Box 50167
Honolulu, HI 96850

Mattlin, Dr. R. H.
Fisheries Research Division
Ministry of Agriculture
and Fisheries
P. O. Box 297
Wellington, New Zealand

McKenzie, Ms. Tracey P.
40 Butman Street
Beverly, MA 01915

Merrell, Mr. Theodore R., Jr.
Auke Bay Laboratory
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
P. O. Box 210155
Auke Bay, AK 99821

Milone, Mr. Peter
Western Pacific Program Office
Southwest Region
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Montgomery, Ms. Suzanne
Washington Communications Service
150 North Muhlenberg Street
Woodstock, VA 22664

Morin, Ms. Marie
Division of Forestry and
Wildlife, DLNR
1151 Punchbowl Street
Honolulu, HI 96813

Naughton, Mr. John J.
Western Pacific Program Office
Southwest Region
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Neilson, Ms. Judie A.
Oregon Department of
Fish and Wildlife
P. O. Box 3503
Portland, OR 97208

Nelson, Mr. Russell E., Jr.
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Nishimoto, Mr. Michael L.
U.S. Fish and Wildlife Service
202 W. Pioneer Avenue
Homer, AK 99603

Nitta, Mr. Eugene T.
Western Pacific Program Office
Southwest Region
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Ogren, Mr. Larry H.
Panama City Laboratory
Southeast Fisheries Center
3500 Delwood Beach Road
Panama City, FL 32407-7499

Paul, Mr. Thomas W.
Box 8600
Port Alexander, AK 99836

Pecci, Mr. Ken
Northeast Fisheries Center
National Marine Fisheries Service
Woods Hole, MA 02543

Perrin, Dr. William F.
Southwest Fisheries Center
National Marine Fisheries Service
P. O. Box 271
La Jolla, CA 92038

Phelan, Mr. Dennis
U. S. Senate Commerce Committee
6709 Kerns Road
Falls Church, VA 22042

Reed, Mr. Ronald K.
Pacific Marine Environmental
Research Laboratory
7600 Sand Point Way, NE
Bin C15700, Bldg. 3
Seattle, WA 98115

Reichman, Mr. Alan
Greenpeace USA
6802 Linden N
Seattle, WA 98103

Saito, Mr. Ralph S.
Division of Forestry
and Wildlife, DLNR
1151 Punchbowl Street
Honolulu, HI 96813

Sakuda, Mr. Henry M.
Division of Aquatic
Resources, DLNR
1151 Punchbowl Street
Honolulu, HI 96813

Sampaga, Mr. Jeffrey
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Sautter, Mr. Raymond
Law Enforcement Division
Southwest Region
National Marine Fisheries Service
P. O. Box 50242
Honolulu, HI 96850

Schumacher, Dr. James D.
Pacific Marine Environmental
Research Laboratory
7600 Sand Point Way, NE
BIN C15700, Bldg. 3
Seattle, WA 98115

Scordino, Mr. Joe
Northwest Region
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Seckel, Mr. Gunter R.
P. O. Box 831
Monterey, CA 93942

Seki, Mr. Michael P.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Shima, Mr. Kazuo
Counsellor, Oceanic Fisheries
Department
Fisheries Agency
1-2-1 Kasumigaseki, Chiyoda-ku
Tokyo, Japan

Shiota, Mr. Paul M.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Shomura, Mr. Richard S.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Simonds, Ms. Kitty
Western Pacific Regional Fishery
Management Council
1164 Bishop Street, Suite 1405
Honolulu, HI 96813

Simonsen, Mr. Stanley
Owner, GOLDEN FLEECE
4801 Hyada Boulevard, NE
Tacoma, WA 98422

Sixberry, Mr. Richard
Division of Aquatic
Resources, DLNR
1151 Punchbowl Street
Honolulu, HI 96813

Snyder, Dr. George R.
Auke Bay Laboratory
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
P. O. Box 210155
Auke Bay, AK 99821

Steiner, Mr. Rick
University of Alaska
Marine Advisory Program
P. O. Box 521
Cordova, AK 99574

Stewart, Mr. Brent S.
Hubbs Sea World Research
Institute
1700 South Shores Road
San Diego, CA 92109

Szyper, Mr. Jim
Fisheries Development Unit
Division of Aquatic
Resources, DLNR
1151 Punchbowl Street, #330
Honolulu, HI 96813

Takahashi, Ms. Caroline
Greenpeace Hawaii
19 Niolopa Place
Honolulu, HI 96817

Taylor, Mr. Robert
222 La Plata
Santa Barbara, CA 93109

Tillman, Dr. Michael F.
IUCN Conservation
Monitoring Centre
219(C) Huntingdon Road
Cambridge CB3 0DL, United Kingdom

Tonsich, Ms. Frances M. (staff)
Southwest Fisheries Center
National Marine Fisheries Service
P. O. Box 271
La Jolla, CA 92038

Twiss, Mr. John R., Jr.
Marine Mammal Commission
1625 Eye Street, NW
Washington, D.C. 20006

Uchida, Mr. Richard N.
Southwest Fisheries Center
Honolulu Laboratory
National Marine Fisheries Service
P. O. Box 3830
Honolulu, HI 96812

Vauk, Dr. Gottfried J. M.
Instituts für Vogelforschung
Vogelwarte Helgoland Inselstation
Postf. 1220, 2192 Helgoland
Federal Republic of Germany

Vauk-Hentzelt, Dipl. Biol. Erika
Instituts für Vogelforschung
Vogelwarte Helgoland Inselstation
Postf. 1220, 2192 Helgoland
Federal Republic of Germany

Wallace, Ms. Nancy
The Entanglement Network
6404 Camrose Terrace
Bethesda, MD 20817

Waring, Mr. Gordon T.
Woods Hole Laboratory
Northeast Fisheries Center
National Marine Fisheries Service
Woods Hole, MA 02543

Wathne, Mr. Fred
Northwest and Alaska
Fisheries Center
National Marine Fisheries Service
7600 Sand Point Way, NE
BIN C15700
Seattle, WA 98115

Webb, Mr. Bruce E.
Animal Protection Institute
P. O. Box 22505
Sacramento, CA 95822

White, Ms. Sue Difloure
1302-C Kamahale Street
Honolulu, HI 96817

Yoshida, Mr. Kazumoto
Assistant Director
Far Seas Fisheries Research
Laboratory
7-1, 5 chome, Orido
Shimizu 424, Japan

APPENDIX D

LIST OF TITLES--BACKGROUND PAPERS AND WORKING PAPERS

BACKGROUND PAPERS

- N. Wallace
Bibliography on entanglement.
- K. Middleton
Ghost gillnets haunt both fishermen and scientists.
- R. J. Morris
Floating plastic debris in the Mediterranean.
- M. J. Bean
United States and international authorities applicable to entanglement to marine mammals and other organisms in lost or discarded fishing gear and other.
- N. Wallace
Solutions to debris entanglement or "Think of it as a big fishbowl."
- B. Heneman
Records of pinniped entanglement in fishing gear at southeast Farallon Island.
- C. Hammond
Derelict gill net reported to National Marine Fisheries Service, Alaska Region in 1983.
- J. Grove
Plastic pollution in the Galapagos.

WORKING PAPERS

INTRODUCTION

- M. Gosliner
Legal authorities pertinent to entanglement by marine debris.

SESSION I

- R. N. Uchida
The types and estimated amounts of fish net deployed in the North Pacific.
- Y. Gong
Distribution and migration of flying squid, Ommastrephes bartrami (LeSueur), in the North Pacific.

L.-L. Low, R. E. Nelson, Jr., and R. E. Narita
Net loss from trawl fisheries off Alaska.

J. Neilson
The Oregon experience.

T. R. Merrell, Jr.
Fish nets and other plastic litter on Alaska beaches.

L. L. Jones and R. C. Ferrero
Observations of net debris and associated entanglements in the North Pacific Ocean and Bering Sea, 1978-84.

J. R. Henderson and M. B. Pillos
Accumulation of net fragments and other marine debris in the Northwestern Hawaiian Islands.

M. L. Dahlberg and R. H. Day
Observations of man-made objects on the surface of the North Pacific Ocean.

W. H. Lenarz
Theoretical first approximations of densities of discarded webbing in the eastern North Pacific Ocean and Bering Sea.

R. A. Fredin
Fishing effort by net fisheries in the North Pacific Ocean and Bering Sea since the 1950's.

K. Shima
Summary of Japanese net fisheries in the North Pacific Ocean.

T. F. Chen
High sea gill net fisheries of Taiwan.

SESSION II

N. Wallace
Debris entanglement in the marine environment: A review.

J. Scordino
Studies on fur seal entanglement, 1981-84, St. Paul Island, Alaska.

C. W. Fowler
An evaluation of the role of entanglement in the population dynamics of northern fur seals on the Pribilof Islands.

D. G. Calkins
Steller sea lion entanglement in marine debris.

B. S. Stewart and P. K. Yochem
Entanglement of pinnipeds in net and line fragments and other debris in the Southern California Bight.

J. R. Henderson

A review of Hawaiian monk seal entanglements in marine debris.

M. W. Cawthorn

Entanglement in and ingestion of plastic litter by marine mammals, sharks, and turtles in New Zealand waters.

R. H. Day, D. H. S. Wehle, and F. C. Coleman

Ingestion of plastic pollutants by marine birds.

G. H. Balazs

Impact of ocean debris on marine turtles: Entanglement and ingestion.

W. L. High

Some consequences of lost fishing gear.

H. A. Carr, E. H. Amaral, A. W. Hulbert, and R. Cooper

Underwater survey of simulated lost demersal and lost commercial gill nets off New England.

K. Yoshida and N. Baba

The problem on entanglement of fur seals in marine debris.

B. R. Mate

Incidents of marine mammal encounters with debris and fishing gear in Oregon.

SESSION III

G. R. Seckel

Currents of the tropical and subtropical North Pacific Ocean.

R. K. Reed and J. D. Schumacher

On the general circulation in the subarctic Pacific.

J. A. Galt

Oceanographic factors affecting the predictability of drifting objects at sea.

T. Gerrodette

Toward a population dynamics of marine debris.

L. Magaard

The oceanic circulation in Hawaiian waters: Facts, hypotheses, and plans for further investigations.

APPENDIX E

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BIBLIOGRAPHY ON ENTANGLEMENT

Nancy Wallace
The Entanglement Network
6404 Camrose Terrace
Bethesda, Maryland 20817

Ainley, D. G., et al.

1981. Mortality of seabirds in high-seas salmon gill nets. Fish. Bull., U.S.79(4):800-806. Scientific update on statistics of Japanese high-seas salmon incidental seabird take using research and commercial vessel statistics.

Alaska Fishermen's Journal.

1983. Derelict nets found off Kodiak. 40 p.

_____. Satellite tracks humpback whale. Transmitter attached to whale during disentangling from net off Newfoundland tracked movements for six days--more such tagging planned.

Andre, J. B., and R. Ittner.

1980. Hawaiian monk seal entangled in fishing net. 'Elepaio 41:51.

Animal Welfare Institute Quarterly.

1983. The fishermen's "accidental" harvest. Extract from Caught by accident--the fishermen's unwanted harvest by F. C. Coleman and D. H. S. Wehle, Oceans Mag. July 1983. Anim. Welfare Inst. Q. 32(3), 10 p.

Anonymous.

1973. Seabird slaughter. Sports Fish. Inst. Bull. 203, 5 p. Very early observed mortality of thick-billed murre from one Danish off-shore salmon driftnet fishery vessel in 1965, in the northwest Atlantic.

1973. Japanese monofilament salmon nets found in Cook Inlet. Alaska Mag. 39(12):25. A monofilament net 66 m long was found on a beach in Cook Inlet, Alaska, in 1973 with many feathers of seabirds and seal skull.

1974. Sea secrets. Vol. 18, p. 8-9.

Austin, B. C., and G. T. Waugh.

1983. Drift fishery management plan, regulatory impact review, management council. South Atlantic Fishery Management Council. 73 p. and appendices. Several boats have augmented their fishery effort for swordfish using drift gill nets at night. Drift gill nets are proposed to be banned in the mid-northwest Atlantic to avoid this increased effort and expected catch above optimum yield

for the stock, and to avoid potential marine mammal and turtle interactions and conflicts with other fishing gear.

Australian National Parks and Wildlife Service, and Department of Primary Industry.

1983. Incidental catch of small cetaceans in a gill net fishery in northern Australian waters. Report on approximately 4,700 small cetaceans caught in the Taiwan gill net fishery.

Balazs, G. H.

1979. Synthetic debris observed on a Hawaiian monk seal. 'Elepaio, 40(3):43-44.

Beach, R. J., et al.

1976. Entanglement of an Aleutian reindeer in a Japanese fish net. Murrelet 57, 66 p.

Bedford, D.

1983. Pelagic shark/swordfish drift gill net fishery management information document. Draft copy, 87 p. Response to a California legislature directive to examine the impact of the new drift gill net fishery for sharks that indiscriminate incidental take. Nets are effective at catching targeted thresher sharks and a valuable bycatch of swordfish, which then became targeted. The large number of blue sharks taken incidentally are in competition with and may cause a loss to a longline fishery targeting this species because sharks caught in gill nets usually spoil. Incidental take of California sea lions is estimated at 500-1,500 annually and is concentrated in spring and early summer around the outer Channel Islands. The greater swordfish catch is in autumn. Recommendations for management focus on license limits, mesh size, and season and area closures to prevent or mitigate problems.

Berland, B.

1971. Piggha of lundefugl med gummistrik. Fauna (Blindern) 24:35-37. Two out of nine puffins shot off Hordaland, Norway on February 15, 1970 had several thick bright red rubber threads in the stomachs; and elastic bands formed a collar around the neck of a dogfish (Squalus acanthias) off southern Norway.

Bernard, F. R.

1981. Canadian west coast flying squid experiment fishery. Can. Ind. Rep. Fish Aquat. Sci. 122, 23 p. An experimental drift gill net fishery for squid off Vancouver Island was attempted by Japan and Canada. Monofilament gill nets in sets of at least 15 km up to 35-45 km were set either on the surface or down to some 10 m below the surface. Incidental take was low in properly placed nets, and was composed of pomfret, blue shark, salmon shark, tuna, and salmon. Several guidelines on fishing area, water temperature, and net setting techniques discussed to lower bycatch of these commercially valuable species.

Besson, J.

1973. Alauda 41:165-167.

Biddy, C. J.

1971. Auks drowned by fishnets. Seabird report No. 2. Report on numbers of alcids caught in nets for Atlantic salmon around coasts of Ireland and Scotland.

1972. Seabird report. Vol. 2, p. 48-49.

Bigg, M.

1979. Incidence of adult northern fur seals entangled in debris on St. Paul Island, 1978. Submitted to 22d Annual Meeting of the Standing Scientific Committee, North Pacific Fur Seal Commission.

1982. Sizes of scrap fishnet and plastic packing bands from western Vancouver Island during August-September 1982. Submitted to the 26th Annual Meeting of the Standing Scientific Committee, North Pacific Fur Seal Commission, 3 p., reports on smaller size beach scraps than found on live seals.

Bonner, W. T., and T. S. McCann.

1982. Neck collars on fur seals, Arctocephalus gazella at South Georgia. Br. Antarct. Surv. Bull. 57:73-77.

Bourne, W. R. P.

1972. Threats to seabirds. Int. Counc. Bird Preservation Bull. 11:200-218. One of the earliest discussions of incidental kill of seabirds, focussed on high seas salmon operations.

1976. Seabirds and pollution. In R. Johnston, Marine pollution. Academic Press, N.Y. Excellent early discussion of known impact of "artifacts" on seabirds, including separate regional and species-by-species roundup of all known entanglement, incidental and debris, to date. Interesting discussion of role of natural regurgitation in lower mortality in some species from debris.

Brongersma, L. D.

1968. Notes upon some turtles from the Canary Islands and from Madeira. Proc. K. Ned. Akad. Wet. Ser. C Biol. Med. Sci. 71:128-136. A report indicating occurrence of plastic in sea turtle stomachs.

1972. European Atlantic turtles. Zool. Verhand. (Leiden) 121:1-318. A report of plastic bags in sea turtle stomachs.

Brown, B. E.

1983. Ghost gill net research: Progress in developing programs to address gill net research. Northeast Fisheries Center Memorandum, 1 p. This memo lists seven specific plans being implemented to address concerns about effects of gill nets on resources and other activities. Plans include research cruises, information gathering, and data analysis aimed at characterizing gillnetting areas, fishery resources and techniques, and abandoned gill net concentrations in the northeast U.S.

Burton, R.

1983. MARPOL treaty will combat oil pollution from ships, but sea still cluttered with other rubbish. Fish. News Int., November 1983, p. 38. Brief article reviews gains in halting oil dumping, and reviews wide range and occurrence of plastic pollution around world.

Calder, C.

1984. Bacteria and gill nets slaughtering seals. Burrell's August 16 1984. Extremely high rate of incidentally killed marine mammals, as high as 6 harbor porpoises in 10 days, are washing up on northern California beaches during gillnetting season despite recent legislative restrictions. California Academy of Sciences research feels commercially valuable beach may be affected by great white shark attracted to dead marine mammals. Bird mortality seems down.

Cardenas, J. C., et al.

1984. Problemas de Manejo Que Afectan a Las Poblaciones de Cetaceos Menores en Chile. (Management Problems Affecting Populations of Small Cetaceans in Chile). Comité Nacional Pro Defensa de la Fauna y Flora. Review of present knowledge of small cetaceans, severe pressure from commercial harvest for crab bait, live export and incidental catch in fisheries is discussed, 11 p.

Carpenter, E. J., and K. L. Smith, Jr.

1972. Polystyrene sperules in coastal waters. Science, N.Y. 178:749-750.

Carr and Stancyk.

1975. A report on plastic in sea turtle stomachs. Biol. Conserv. 8: 161-172.

Center for Environmental Education Report.

1984. Ghost nets haunt the seas. Cent. Environ. Rep. 2(1), Jan. 1984.

Christensen, O., and W. H. Lear.

1972. Bycatches in salmon drift-nets at West Greenland in 1972. Medd. Gronl. 5(205):1-29.

Cline, D. R., et al.

1979. Social and economic values of marine birds. In J. C. Bartonek and E. N. Nettleship (editors), Conservation of marine birds of northern North America, p. 173-182. U.S. Fish Wildl. Serv., Wildl. Res. Rep. 1.

Coleman, F. C., and D. H. S. Wehle.

1983. Caught by accident: The fisherman's unwanted harvest. Oceans Mag., July 1983, p. 65-69. Comprehensive presentation for general public of incidental take, ghost take, birds, mammals, and fish.

Colton, J. B., Jr., F. D. Knapp, and B. R. Burns.

1974. Plastic particles in surface waters of the northwestern Atlantic. Science (Wash. D.C.) 185:491-497.

Conant, S.

1984. Man-made debris and marine wildlife in the Northwestern Hawaiian Islands. 'Elepaio 44(9):87-88. Observations of entanglement of immature masked booby in net; cites personal communications on reduction in Hawaiian monk seal mortality after Lisianski Island beach clearing; notes green sea turtle and seabirds colonies would also benefit from Northwestern Hawaiian Islands clean-up.

Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter. (London Dumping Convention) Annex I.

1972. Lists "Persistent plastics and other persistent synthetic materials" with examples and criteria under the completely prohibited Annex I listing.

Court, W. G.

1981. Recent trends in the Japanese fishery for squid, Ommastrephes bartrami. Southwest Fish. Cent., Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Admin. Rep. H-81-8, 1 p. The development and very rapid expansion since 1978 of drift gill net fishing for red (flying) squid caused controversial problems of competition with less efficient jigging. Regulation has been imposed to control severe competition, manage the resource in the face of highly efficient gillnetting, and mitigate incidental catch of salmon. Boat, area, season, and net restrictions have been imposed.

Crouse, D. T.

1982. Incidental capture of sea turtles by U.S. commercial fisheries. Report to the Center for Environmental Education, Wash. D.C., 19 p.

Cundell, A. M.

1973. Plastic materials accumulating in Narragansett Bay. Mar. Pollut. 4:187-188.
1974. Plastic in the marine environment. Environ. Conserv. Mag. 1:63-68.

Daily Yomiuri.

1984. Agency admits Japanese nets may cause fur seal deaths. Daily Yomiuri, September 11, 1984.

Day, R. H.

1980. The occurrence and characteristics of plastic pollution in Alaska's marine birds. M.S. Thesis. Univ. Alaska, Fairbanks, 111 p.

DeGange, A. R.

1978. Observations on the mortality of seabirds in Japanese salmon gill nets made from the Oshoro Maru and Hokusei Maru, summary 1978. U.S. Fish Wildl. Serv., Office of Biological Services-Coastal Ecosystems, Anchorage, Alaska, December 1978. Study of seabird mortality and observations on other marine life entanglement aboard two University of Hokkaido, Faculty of Fisheries Training Vessels, including statistics, methods, and bibliography on early seabird mortality work.

1982. Mortality of seabirds in the Japanese high seas salmon driftnet fishery: A summary of data collected by the U.S. Fish and Wildlife Service. U.S. Fish and Wildlife Service, Anchorage, Alaska, March 1982. A summary of data on the mortality of marine birds provided to a workshop on the incidental take of marine birds in Japanese salmon drift net fisheries, Tokyo, Japan, 23-24 March 1982.
- DeGange, A. R., and T. C. Newby.
1980. Mortality of seabirds and fish in a lost salmon driftnet. Mar. Pollut. Bull. 11:322-323.
- Dixon, T. R.,
1978. Tackling U.K. shoreline refuse. Mar. Pollut. Bull. 9:91.
- Dixon, T. R., and A. J. Cooke.
1977. Discarded containers on a Kent beach. Mar. Pollut. Bull. 8:105-109.
- Dixon, T. R., and T. J. Dixon.
1981. Marine litter surveillance. Mar. Pollut. Bull. 12:289-295.
1983. Marine litter distribution and composition in the North Sea. Mar. Pollut. Bull. 14:145-148.
- Dixon, T. R., and C. Hawksley.
1980. Marine litter research programme, stage 3. Report on the First National Shoreline Refuse and Litter Survey. Keep Britain Tide Group.
- Duguy, R., M. Duron, and C. Alzieu.
1980. Observations de tortues luth (Dermochelys coriacea L.) dans les pertuis charentais en 1979. Ann. Soc. Sci. Nat. Charente-Marit. 6(7):681-691. A report of pieces of plastic bags in sea turtle stomach. The turtle was very emaciated and stomach pathology was consistent with an obstruction, seems highly probable the plastic was harmful.
- Duron, M., and P. Duron.
1980. Des tortues luths dans le pertuis charentais. Courr. Nat. 69:37-41. Report that seven out of eight leatherback sea turtles found near La Rochelle, France had ingested plastic.
- Evans, P. G. H., and G. Waterson.
1976. Polar record.
- Evans, W. E.
1971. Potential hazards of non-degradable materials as an environmental pollutant. Naval Underwater Center Symposium on Environmental Preservation, May 30-21, 1970. Naval Underwater Center, San Diego. Discusses two deep submersible incidents with ghost nets, and impact of Naval Underwater Center waterfront ban on styrofoam cup sales with drastic reduction in trash; brief mention of seaquill entanglement in coffee cups and fish mortality from cigarette filters.

Falla, R. A.

1960. Proceedings of the Royal Society of London B. 152:655-659.

Feder, H. M., S. C. Jewett, and J. R. Hilsinger.

1978. Man-made debris on the Bering Sea floor. Mar. Pollut. Bull. 9:52-53.

Feldkamp, S. D.

1983. Effect of net entanglement on the drag and power output of swimming sea lions. Final report to the National National Marine Fisheries Contract No.: NOAA-82ABC-02743. Important study showing 4-fold increase in drag from small fragment around sea lion's neck.

Fiscus, C. H., and P. Kozloff.

1972. Fur seals and fish netting. Appendix E. In Fur seal investigations, 1971. Unpubl. rep. Natl. Mar. Mammal Lab., Fur seal invest. 1971, Appendix E. Mar. Mammal Biol. Lab. Natl. Seattle, Wash.

Fiscus, C. H., A. M. Johnson, and K. W. Kenyon.

1978. Hawaiian monk seal, (Monachus schauinslandi) survey of the Northwestern Hawaiian Islands, July, 1978. Processed Rep., 26 p. Mar. Mammal Biol. Lab., Northwest Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, Seattle, WA 98115. Observations of entanglement in debris.

Fishing News International.

1984. Mediterranean monk, the seal in real danger. Within general presentation of European Community plan for saving the last 500 of this species, incidental entanglement in fishing nets is briefly covered as 2d or 3d highest cause of mortality.

Fowler, C. W.

1982. Entanglement as an explanation for the decline in northern fur seals of the Pribilof Islands. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, Seattle, WA 98115, 24 p. Background paper submitted to the 25th Annual Meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission, April 13-16, 1982, Ottawa, Canada. Major presentation of entanglement as cause of 5-8% annual decline.

1982. Interactions of northern fur seals and commercial fisheries. Trans. N. Am. Wildl. Nat. Resour. Conf. 47:278-292. Detailed statistics on decline and causes, including entanglement.

1983. Status of northern fur seals on the Pribilof Islands. Background paper submitted to the 26th Annual Meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission, Mar. 28-Apr. 8, 1983, Wash. D.C. Comprehensive assessment of current population status, with discussion of entanglement as significant cause of decline, 12 p.

1984. Entanglement in fishing debris as a contributing factor in the decline of northern fur seals on the Pribilof Islands.

Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, Seattle, WA 98115, 33 p. Background paper submitted to the 27th Annual Meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission, Apr. 9-13, 1984, Moscow, U.S.S.R.

Fowler, C. W., J. Scordino, T. R. Merrell, and P. Kozloff.
1983. Entanglement of the Pribilof Island fur seals. In P. Kozloff, (editor), Fur seal investigations, 1982, p. 22-33. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-F/NWC-71.

Friends of the sea otter.

1981. Death nets in Monterey Bay. The Otter Raft, 26, winter.

1981. Gill nets and sea otters. The Otter Raft, 26, winter.

1983. State legislation offers hope, but fishing nets still take toll. The Otter Raft, 29, summer.

Fund for Animals Australia.

1983. Incidental take of cetaceans. Tech. Bull. Analyzes and reports on 4,700 cetaceans taken over 21 months of Taiwan gill net fishing of bottlenose, spinner, and spotted dolphins, and false killer whales.

Gentry, R. L., and J. R. Holt. Equipment and techniques for handling fur seals. U.S. Dep. Commer., NOAA Tech. Rep. NMFS, SSRF-758.

Gilbert, J. R., and J. L. Stein.

1981. Harbor seal populations and marine mammal fisheries interactions. 1981 Annual Report to Northeast Fisheries Center, Natl. Mar. Fish. Serv., NOAA, 39 p., with 10 appendices. Report on northeast marine mammal populations identifies real or potential fisheries interactions, including three gill net fisheries, via several reporting sources. The groundfish set gill nets seem to involve minor fish loss but some gear loss, with some incidental take of seals and porpoises, and little of large whales. The developing swordfish drift gillnetting has potential for incidental take but no real demonstrated effect yet. The mackerel fishery in winter had a potential high takes of porpoises and some known take. Seals also may be entangled, and sometimes take mackerel from surface nets. The appendix on permits for incidental take reported gill nets as significant in cetacean take.

Gilbert, J. R.

1983. Drift application by New England gill-netters for a small-take exemption and application for permit for scientific research collection of carcasses. This unprecedented permit procedure is proposed since groundfish gillnetting catches 100-200 harbor porpoise and 25-50 harbor seals annually, with occasional net damage.

1983. Proposed approach to the documentation of marine mammal conflicts with groundfish gill net fisheries in the Gulf of Maine,

5 p. Surface set gill nets averaged 4.8 entanglements and 1.4 mortalities per gill-netter per season, and 17 groundfish gill-netters with bottom sets reported takes of 118 porpoises and 22 seals in 1982. A permit and research proposal is described to further document and characterize aspects that may be useful in reducing the problems.

Gilbert, J. R., and K. M. Wynne.

1983. Harbor seal populations and marine mammal fisheries interactions, 1982. Second Annual Report to Northeast Fish. Cent. Natl. Mar. Fish. Serv., NOAA, 43 p. Focuses on groundfish and mackerel gill net fisheries as the most significant in marine mammal interactions among northeast fisheries involving predominantly Atlantic white-sided dolphins, harbor porpoises, and harbor seals. Details on rates, areas, and types of incidental take are discussed and preventive measures suggested.

Gill, P. F.

1982. Garbage from ships. Mar. Pollut. Bull. 13, p. 291.

Gilmartin, W. G.

1983. Recovery plan for the Hawaiian monk seal, Monachus schauinslandi. In cooperation with the Hawaiian Monk Seal Recovery Team, U.S. Dep. Commer., March 1983. Incidence of entanglement presented on p. 9, including occurrence of human disentangling of four weaned pups in 1982.

Gochfeld, M.

1973. Effect of artifact pollution of the viability of seabird colonies on Long Island, New York. Environ. Pollut. 4:1-6.

Gray, S., and J. Lien.

1980. Fisherman's guide: whale alarm experiment. Whale Research Group, Memorial Univ. of Newfoundland, 9 p. This illustrated brochure instructs inshore fishermen cooperating in experimental tests of the effectiveness of various alarms to prevent whales colliding with fishing gear. The test design includes placing electronic pingers on set gill nets.

Gregory, M. R.

1977. Plastic pellets on New Zealand beaches. Mar. Pollut. Bull. 8:82-84.

1978. Accumulation and distribution of virgin plastic granules on New Zealand beaches. N.Z. J. Mar. Freshwater Res. 12:399-414.

1983. Virgin plastic granules on some beaches of eastern Canada and Bermuda. Mar. Environ. Res. 10:73-92.

Greenpeace Examiner.

1983. Invisible killer: This ghost is real, p. 16-17.

Gress, F., and D. Anderson.

1983. Draft California brown pelican recovery plan. U.S. Fish Wildl. Serv., Portland, Oreg. Excellent public education portion of recovery plan, with special attention to teaching public how to handle and disentangle hooked or entangled birds, with cost and agency factors presented. Excerpts p. 58-63, 74, 75, 78, 85, 110-113, and Part III task 265, 215, and related public education tasks.

Hays, H., and G. Cormons.

1974. Plastic particles found in tern pellets, on coastal beaches, and at factory sites. Mar. Pollut. Bull. 5:44-46.

Henderson, J.

1983. Encaptures and entanglement of Hawaiian monk seals with lost and discarded fishing gear. Abstracts of the 5th Biennial Conference on the Biology of Marine Mammals. Soc. Mar. Mammal.

Hirth.

1971. Fisheries synopsis 85. U. N. Fish. and Agric. Organ., Rome. A report on plastic in sea turtle stomachs.

Holgerson, H.

1961. Sterna 4:229-240.

Horsman, P. V.

1982. The amount of garbage pollution from merchant ships. Mar. Pollut. Bull. 13:167-169.

Hoyt, E.

1983. Plight of the pinnipeds. Defenders Mag. May/June 1983, p. 15-19. Observation of northern sea lion entangled in debris.

Hughes.

1974a. The sea turtles of South-East Africa. I. Status, morphology and distribution. S. Afr. Assoc. Mar. Biol. Res., Oceanogr. Res. Inst. Invest. Rep. 35, 144 p.

1974b. The sea turtles of South-East Africa. II. The biology of the Tongaland loggerhead turtle Caretta caretta L. with comments on the leatherback turtle Dermochelys coriacea L. and the green turtle Chelonia mydas L. in the study region. S. Afr. Assoc. Mar. Biol. Res., Oceanogr. Res., Oceanogr. Res. Inst. Invest. rep. 36, 96 p. A report of 3 x 4 meter piece of plastic in sea turtle stomachs.

Humane Society Close-up Report.

1984. Why is the fur seal population declining? Spring.

International Maritime Organization.

1983. Regulations for the prevention of pollution by garbage from ships. Int. Conf. Mar. Pollut., 1973 (1977 edition), Annex V, p. 122-125.

International North Pacific Fisheries Commission.

1982. Proceedings of the 29th Annual Meeting. Other business conducted at the meeting addressed concerns that developing high

seas drift gill net fisheries for squid and for marlin might incidentally catch salmon species. Flying (red) squid was the main target species discussed, and discussion centered on distributional factors of squid and salmon and potential for overlap and incidental take.

International North Pacific Fisheries Commission, United States Section.

1983. Report of the U.S. Delegation to the 30th Annual Meeting, November 1-3, 1983, Anchorage, Alaska. NMFS Entanglement Workshop was raised under other matters, with Canada suggesting reporting system under INPFC Secretariat, and much concern over incidental catch of salmon from lost and discarded squid nets.

International Wildlife.

1977. Wildl. Omnibus. March/April 1977. Brief, early report on incidental seabird mortality.

Jacobsen, M. A.

1947. An impeded herring gull. Auk 64, 619 p.

Japan.

1969. Investigation into the origin of net fragments on fur seals. Background paper submitted to the 12th Annual Meeting of the Standing Scientific Committee, North Pacific Fur Seal Commission.

Japan Fisheries Agency.

1982. Squid drift gill net fishery. Drift nets are set at night about 10 m below the surface for the targeted species flying squid. The Japanese squid drift gill net fishery started in 1978 and is more efficient and competitive than jigging operations. Mesh size must be between 100 and 135 mm. Salmon and trout catch is prohibited and incidental take has been prevented seemingly by area limitations on squid fishing.

Jewett, S. C.

1976. Pollutants of the northeastern Gulf of Alaska. Mar. Pollut. Bull. 7:169. Human-made debris, primarily plastics, was found in 57% of benthic trawls.

Jones, L. L.

1981. U.S. research on the incidental take of marine mammals by Japanese mothership fishery: 1981 progress report. Natl. Mar. Mammal Lab., Seattle, WA, 27 p. Results of incidental take of Dall's porpoise and northern fur seals by salmon gill nets is reported. Some 2,000 porpoises in the U.S. FCZ were taken in over 6,000 sets. Estimated take of seals was about 0.015 per set. Behavior of the marine mammals near or entangled in nets is discussed, and biological data collected are reported.

Jones, L. L.

1982. Incidental take of Dall's porpoise and harbor porpoise by Japanese salmon drift net fisheries in the western North Pacific. Report of the International Whaling Commission, SC/35/Sm8, 8 p. Vessel reported rates of incidental catch did not agree with observer recorded rates; discusses factors affecting these rates.

Kartar, S., F. Abou-Seedo, and M. Sainsbury.

1976. Polystyrene spherules in the Severn Estuary--a progress report. Mar. Pollut. Bull. 7:51.

Kartar, S., R. A. Milne, and M. Sainsbury.

1973. Polystyrene waste in the Severn Estuary. Mar. Pollut. Bull. 4:144.

Kenyon, K. W.

1980. No man is benign, the endangered monk seal. Oceans Mag. 13(3):48-54. Observations of Hawaiian monk seal entangled in debris.

Kenyon, K. W., and E. Kridler.

1969. Laysan albatrosses swallow indigestible matter. Auk 86:339-343.

King, W. B.

1975. International Council of Bird Preservation Bulletin XII, p. 259-260.

King, W. B., R. G. B. Brown, and G. A. Sanger.

1979. Mortality to marine birds through commercial fishing. In J. C. Bartonek and D. N. Nettleship (editors), Conservation of marine birds of northern North America, p. 195-199. U.S. Fish Wildl. Serv., Wildl. Res. Rep. 11. Estimates of annual seabird mortality for Japanese North Pacific salmon fishery.

Kozloff, P.

1979. Fur seals entangled in fishing debris and other materials. Submitted to the 22d Annual Meeting of the Standing Scientific Committee, North Pacific Fur Seal Commission.

Kumagai, J., et al.

1982. Gear experiment in order to prevent incidental take of Dall's porpoises conducted in 1981. Project team by Northern Sea Salmon Mothership Council and Federation of Japan Salmon Fisheries Cooperative Association for the development of techniques to prevent incidental take of Dall's porpoises.

1983. The 1983 testing of fishing gears to prevent the incidental take of Dall's porpoise (Phocoenoides dalli). Northern Sea Salmon Mothership Council and Federation of Japan Salmon Fisheries. Review of air tube threads and electronic sound devices for preventing incidental take of Dall's porpoises.

Lien, J., and D. Aldrich.

1982. Damage to inshore fishing gear in Newfoundland and Labrador by whales and sharks during 1981. CAFSAC Marine Mammal Commission Meeting, May 1982. Newfoundland Institute for Cold Ocean Science, Contract No. 6. Reports of gear loss by fishermen tentatively show a decreased incidence involving large whales but an increased incidence of basking sharks and pilot whales.

J., et al.

1982. Whale entrapment in inshore fishing gear during 1982; a preliminary report to Fisheries and Oceans Canada. NICOS contract No. 26, 1 p. Fishermen reports of incidental catch of whales and sharks decreased again in 1982.

Lien, J., and P. McLeon.

1980. Humpback collisions with fishing gear in Newfoundland: Arbitration and education in a whale-fisherman dispute. N.W. Endangered Species Workshop, May 7-11, 1980, Provincetown, Massachusetts, 33 p. Indepth paper on Newfoundland's inshore fishery with baleen whales, primarily humpbacks, colliding with fixed fishing gear. At least 30 cetaceans and about \$3 million in gear and fish were lost in 1979. Emphasis is put on the attitudes of the fishers and how they are being changed.

Lien, J., and B. Merdsoy.

1980. Questions and answers about the whale problem in the inshore fishery. Whale Research Group, Memorial University of Newfoundland, 8 p.

Los Angeles Times.

1983. Once periled sea otter may be in trouble again. March 17, 1983. Update on sea otter's halted recovery, gill nets as main problem.

Louglin, T. R., et al.

1983. Incidental catch of marine mammals by foreign fishing vessels--1978-1981. Mar. Fish. Rev. 45(7-8-9):44-49.

Machidori, S., and T. Satoh.

_____. Research report on pomfret (Brama japonica) in the North Pacific Ocean. Japan Fisheries Agency, 10 p. and tables. Salmon research programs indicated an abundance of pomfret and a potential fishery for them by surface gillnetting in areas of salmon distribution. Large mesh size and experimental fishing avoided most salmon bycatch, but shark and tuna were caught in southern areas of pomfret distribution. Some coho and chum salmon were caught and returned.

Major, R. L.

1982. Yield loss of western Alaska chinook salmon resulting from the large Japanese mothership catch of 1980. Document submitted to Annual Meeting International North Pacific Management Council, October 1982, 27 p. This report addresses the issue of mortality of fish that encounter high seas gill nets but are not caught (noncatch mortality), which produces loss in yield. Estimates for immature salmon of one killed for every one landed are mentioned, and for adults one killed for every three landed. A yield loss estimate to a potential inshore fishery capable of catching all fish available to it is 6.51 times the high seas catch, or in other words the inshore fishery could increase yield 551 percent.

Marine Mammal News.

1984. A plea to bring up the issue of discarded fishing gear....
February 19(2):4. Summary of presentation by N. Wallace of International Fund for Animal Welfare to U.S. Committee on Ocean Dumping in preparation for London Dumping Convention meeting of February 1984, in request to consider raising matter at meeting.

Marine Mammal Protection Act Newsletter.

1984. The entanglement problem: A need for increased funding. By Rich Tinney, p. 7-8.

Marine Pollution Bulletin.

1970. Vol. 1, 130 p.

1971. Elastic band pollution. (2), 165 p. Elastic rings and bands around the necks of fish in the Danube delta.

Marshall, D. B., et al.

1975. Report of the Committee on Conservation, 1973-1974. Auk 92:126-136. Brief, early report on seabird mortality problem in incidental North Pacific take.

Mate, B. R.

1980. Workshop on marine mammal-fishery interactions in the northeast Pacific. Final report to the Marine Mammal Commission, 48 p. This general assessment addresses in general all fisheries and mammal species with interaction potential, with little detailed breakdown by individual fishery.

Melville, D.

1973. Seabird report, 3:47-50.

Merrell, T. R., Jr.

1980. Accumulation of plastic litter on beaches of Amchitka Island, Alaska. Mar. Environ. Res. 3:171-184.

1984. A decade of change in nets and plastic litter from fisheries off Alaska. Mar. Pollut. Bull. 15:378-384. Reduction in litter from detailed beach surveys presented, showing marine litter could be rapidly reduced if disposal of litter at sea were restricted.

Middleton, D.

1983. Ghost gill nets haunt both fishermen and scientists. Natl. Fisherm. Yearbook. 63(13):108. Brief note discusses how gill nets are lost or discarded, perceived problems from them, and the lack of understanding of the action and real impact of these nets on fish and lobster. Studies in the northwest Atlantic to document fishing activity and fate of ghost nets are mentioned.

1983. Gillnetting: A viable alternative or a dead end? Natl. Fisherm. Yearbook 63(13):102-105. Gillnetting for groundfish in Massachusetts increased dramatically from 1978 to 1982 as a cost-effective, fuel-efficient fishing method that attracted many boats, until catches declined and smaller fish were being taken. Real or

potential problems involving gear conflicts and claims of environmental damage, excessive incidental catch of lobster, unfair competition, and overfishing were exacerbated. Gear conflicts involved mobile-gear fishermen dragging through gill nets and recreational and charter-boat fishermen snagging lures on gill nets. Gear mishandling and loss were problems with gill-netters new to the method, but little information is yet documented on net numbers, net loss, and efficiency and destructiveness of the monofilament and multifilament nets used.

Miller, N. D., et al.

1983. California marine mammal-fishery interaction study, 1979-1981. Gill net fisheries. Southwest Fish. Cent. La Jolla Lab., Natl. Mar. Fish. Serv., NOAA, Admin. Rep. LJ-83-13 C-233, p. 72-102. The characteristics and rapid expansion of gill net fisheries are described, along with concerns about potential conflicts with other gear, fisheries, and nontarget species. Fisheries and attendant marine mammal interactions are discussed by target species of the gill-netters. Shark drift gillnetting and California halibut gillnetting produce the greatest entanglement impact. For all gill net fisheries combined at least 1,000 sea lions 100 harbor seals, some 25 elephant seals, and 30 pilot whales are drowned annually statewide. Some harbor porpoise, gray whales, and others may also be taken. The greatest loss of fish and gear to mammals is in the halibut fishery, followed in impact by whale entanglement in drift gill nets. Monitoring of the fisheries to gather reliable, comprehensive data was difficult, and management may also be complicated.

Morris, A. W., and E. I. Hamilton.

1974. Polystyrene spherules in the Bristol Channel. Mar. Pollut. Bull. 5:26-27.
1980. Floating plastic debris in the Mediterranean. Mar. Pollut. Bull. 11:125.
1980. Plastic debris in the surface waters of the South Atlantic. Mar. Pollut. Bull. 11:164-166.

Mrosovsky, N.

1981. Plastic jellyfish. Mar. Turtle Newsl. 17:5-7. Brief but major presentation of recent leatherback stomach analyses indicating ingesting of plastic is common with 44% of leatherbacks having plastic in their stomachs.

National Academy of Sciences, U.S.

1975. Assessing potential ocean pollutants. A report of the study panel on assessing potential ocean pollutants to the Ocean Affairs Board, Commission on Natural Resources, National Research Council, Washington, D.C., p. 405-438.

National Marine Fisheries Service, U.S.

1973. NMFS finds tons of plastic debris on Alaska Island. NOAA Week 4(14):1.

1979. Annual report on Dall's porpoise-salmon research. 10 p. Due to incidental take of Dall's porpoises (perhaps up to 20,000 annually), and some northern fur seal in Japanese salmon gill nets, a cooperative observer and research program was conducted in the North Pacific involving catcher boats and dedicated vessels to study mammal mortality and populations.

1983. Environmental assessment of a program to reduce the incidental take of sea turtles by commercial shrimp fishing in the U.S.

New York Times.

1984. Tiny turtles' big secret, a mysterious and perilous journey, is discovered. By Eric Pace, February 21, 1984. Lengthy article on early years of sea turtles on sargassum rafts, brief mention of mortality through styrofoam fragments, oil and tar as baby turtles bite anything.

North Pacific Fur Seal Commission.

1967. Proceedings of the 10th Annual Meeting, February 13-17, 1967, Washington, D.C., 48 p.

1975. Proceedings of the 18th Annual Meeting, March 10-14, 1975, Washington, D.C., 45 p.

1976. Proceedings of the 19th Annual Meeting, March 22-25, 1976, Moscow, U.S.S.R., 38 p.

1978. Proceedings of the 21st Annual Meeting, April 17-21, 1978, Ottawa, Canada., 43 p.

1980. Proceedings of the 23d Annual Meeting, April 14-17, 1980, Moscow, U.S.S.R., 39 p.

1981. Proceedings of the 24th Annual Meeting, April 13-16, 1981, Tokyo, Japan, 41 p.

1982. Proceedings of the 25th Annual Meeting of the North Pacific Fur Seal Commission, April 13-16, 1982, Ottawa, Canada. North Pac. Fur Seal Comm., Wash., D.C., 49 p.

1983. Proceedings of the 26th Annual Meeting, April 11-14, 1983, Washington, D. C., 56 p., has role of entanglement in overall Commission work.

1984. Proceedings of the 27th Annual Meeting of the North Pacific Fur Seal Commission, April 9-13, 1984, Moscow, U.S.S.R. North Pac. Fur Seal Comm., Wash., D.C., 50 p. Role of entanglement in some populations' decline presented in brief summaries of statements and summaries of Workshop of Population Trends of Northern Fur Seals as Appendix E of Scientific Committee Report, of March 29-30, 1984, Moscow.

Northern Fisherman.

1965. Article opens issue of "ghost nets."

Odate, S. et al.

1983. Comprehensive report of research on marine mammals in the North Pacific Ocean, relating to Japanese salmon drift net fisheries, 1978 to 1982. Document submitted to the International North Pacific Fisheries Commission. Fisheries Agency of Japan, Tokyo, Japan 100, 47 p.

Ogi, H., and T. Tsujita.

1973. Jpn. J. Ecol. 23:201-209.

Ohsumi, S.

1975. Incidental catch of cetaceans with salmon gill nets. J. Fish. Res. Board of Can. 32(7):1229-1235.

Parslow, J. L. F., and D. J. Jeffries.

1972. Elastic thread pollution of puffins. Mar. Pollut. Bull. 3:43-45.

Payne, M. R.

1972. Fur seals Arctocephalus tropicalis and A. gazella crossing the Antarctic convergence at South Georgia. Mammalia 43:93-98.

Perkins, J. S., and P. C. Beamish.

1979. Net entanglements of baleen whales in the inshore fishery of Newfoundland. J. Fish. Res. Board Can. 36:521-528.

Perry, A. M.

1981. Sea pollution--Now the challenge has to be met. Int. Mar. Air. Catering, p. 25-27.

Pettit, T. N., G. S. Grant, and G. C. Whittow.

1981. Ingestion of plastics by Laysan albatross. Auk 98:839-841.

Prescott, J. H., and P. O. Fiorelli.

1981. Review of the harbor porpoise (Phocoena phocoena) in the U.S. northwest Atlantic. Final report to Marine Mammal Commission No. MMC-78/08, 64 p. The section of human interactions and incidental take qualitatively describes the expansion of gillnetting since 1976, and reports of incidental takes are included. Monofilament netting may be acoustically invisible to harbor porpoise.

Ramirez, G. D.

1984. Captura de lobos marinos de un pelo (Otaria flavesceus) en Estado Silvestre, Por Medio de Drogas Inmovilizantes. Capture of southern sea lions in the wild by drug immobilization. Abstract of presentation to the First Conference on the Work of Experts on Marine Mammals of South America (Primera Reunion de Trabajo de Expertos en Mamíferos Acuáticos de América del Sur), June 25-29, 1984, Buenos Aires, Argentina. Presents technique for repeated immobilization of adult sea lions for handling during disentanglement from packing bands and netting over several hours at wild rookery, using self-designed blowpipe and techniques.

Ripley, S. D.

1975. The view from the castle. *Smithsonian Mag.* 6(1), 6 p. Early publicity given to incidental seabird mortality.

Robbins, C. S., and D. W. Rice.

1974. Recoveries of banded Laysan albatrosses (*Diomedea immutabilis*) and black-footed albatrosses (*D. nigripes*). In W. B. King, (editor), *Pelagic studies of seabirds in the central and eastern Pacific Ocean*, p. 232-271. *Smithsonian Contrib. Zool.* 158. As part of an analysis of recoveries, it was found that 57.4% of Laysan and 49.5% of the black-footed albatrosses of the 532 birds recovered from 1973 to 1969 were caught on fishhooks or in nets, and many additional birds were thought to have been recovered because of such entanglement.

Rothstein, S. I.

1973. Plastic particle pollution of the surface of the Atlantic Ocean: Evidence from a seabird. *Condor* 75:344-345.

Salomonsen, F.

1970. Proceedings of the Conference on Productivity and Conservation in Northern Circumpolar Lands. International Union for the Conservation of Nature, Morges, Switzerland, 1970, p. 169-175.

Sanger, Gerald A.

1974. On the effect of fish net scraps and other oceanic debris in northern fur seals. Submitted to the 17th Annual Meeting of the Standing Scientific Committee, North Pacific Fur Seal Commission.

1976. Update on seabird mortality from salmon drift nets. *Pac. Seabird Group Bull.* 3(2):30-32. Review of developments in laws in response to previous publicity; before 200-mile EEZ.

Sanger, G. A., and P. A. Baird.

1977. Aspects of the feeding ecology of Bering Sea avifauna. Environmental assessment of the Alaskan Continental Shelf, annual reports of principal investigators, 12:372-417. U.S. National Oceanic and Atmospheric Administration, Environmental Research Laboratory, Boulder, Colorado. This final report presents a review of published and unpublished literature pertinent to the feeding ecology of Bering Sea birds. The authors discuss imbalances which may have been created in the ecosystem from commercial fisheries activities, and how those changes may have benefited planktivorous birds. Recommendations for further research are included.

Sano, O.

1978. Seabird entangled in salmon drift nets. *Fish. Res. News*, Enyo 30:1-4.

Schreiber, R. W., and E. A. Schreiber.

1973. *American birds.* 27:711-715.

Scordino, J., and R. Fisher.

1983. Investigations on fur seal entanglement in net fragments,

plastic bands and other debris in 1981 and 1982, St. Paul Island, Alaska. Background paper submitted to 26th Annual Meeting of the Standing Scientific Committee, North Pacific Fur Seal Commission, Mar. 28-Apr. 8, 1982, Wash., D.C. Detailed statistics of records of fur seal entanglement on one of the Pribilof's.

Scott, G.

1965. Atmospheric oxidation and antioxidants. Elsevier: London and Amsterdam. Chapters 3, 5, and 7.

1970. Plastics, rubbers, textiles. Vol. 1, 361 p.

1972. Plastics packaging and coastal pollution. Int. J. Environ. Stud. 3:35-36.

Scott, J. M.

1975. Incidental seabird kills from salmon gill net fisheries. (Pacific Seabird Group Policy Statement No. 2.) Pac. Seabird Group Bull. 2(1):19-20.

Shabecoff, P.

1984. Wildlife refuges: People and policies intrude. New York Times, May 29, 1984. Lengthy article touches briefly on brown pelican prevalence, and the success of off-limits areas in refuges for endangered species recovery.

Sharpe, W.

1983. Gill nets: The lethal curtain. San Francisco Focus, December 1983, p. 59. One page discussion primarily of harbor porpoise problem.

1983. Can we stop the slaughter on the seas? San Francisco Focus, December 1983. Failure of enforcement of incidental take laws in northern California results in widespread shooting of marine mammals, up to 400 sea lions shot per year, total deaths from fisheries about 2,000. Shootings are not considered abnormal and rarely investigated. Lay report.

Shaughnessy, P. D.

1980. Entanglement of Cape fur seals with man-made objects. Mar. Pollut. Bull. 11:332-336.

Shaughnessy, P. D., and A. I. L. Payne.

1979. Incidental mortality of Cape fur seals during trawl fishing activities in South African waters. Fish. Bull. S. Afr. 12:20-25.

Shaw, D. G.

1977. Pelagic tar and plastic in the Gulf of Alaska and Bering Sea: 1975. Sci. Total Environ. 8:13-20.

Shaw, D. G., and G. A. Mapes.

1979. Surface circulation and the distribution of pelagic tar and plastic. Mar. Pollut. Bull. 10:160-162.

Shiber, J. G.

1979. Plastic pellets on the coast of Lebanon. Mar. Pollut. Bull. 10:28-30.

1982. Plastic pellets on Spain's Costa del Sol' beaches. Mar. Pollut. Bull. 13:409-412.

Simon, L.

1984. Back to freedom. Agenda Mag. May/June 1984. During in-depth review of field of wildlife rehabilitation, photos of case of black crowned night heron found imprisoned in a tree and injured by tangle of fishing line, being treated after disentanglement and released into wild.

Sowl, L. W., and J. C. Bartonek.

1974. Seabirds--Alaska's most neglected resource. Transactions of the 39th North American Wildlife and Natural Resources Conference. Wildlife management Institute, Washington, D.C., p. 117-126. Important early discussion of incidental seabird mortality in North Pacific.

Stewart, P. A.

1967. Diving wood ducklings entangled in filamentous algae. Condor 69, 531 p.

Straty, R. R., and R. E. Haight.

1979. Interactions among marine birds and commercial fish in the eastern Bering Sea. In J. C. Bartonek and D. N. Nettleship (editors), Conservation of marine birds of northern North America, p. 201-219. U.S. Fish Wildl. Serv., Wildl. Res. Rep. 11.

The New Scientist.

1971. August 6, 1971, p. 293.

Tiempo.

Denuncia de la Sociedad Protectora de Animales. June 8, 1984.

Tinney, R. T.

1983. A more likely alliance, something for the seals. Oceans Mag. 16(2):65-67. An observation of California sea lion entangled in debris.

Tull, C. E., P. Germain, and A. W. May.

1972. Mortality of thick-billed murre in the west Greenland salmon fishery. Nature (Lond.) 237:42-44. First major paper documenting huge numbers killed in Danish West Greenland salmon fishery, showing excess of annual bird production.

Twiss, J.

Letter of 14 September 1983 to Robert Jantzen, Director of U.S. Fish and Wildlife Service. Recommends certain steps for prohibiting or significantly reducing California sea otter mortality from incidental mortality, as part of comprehensive Marine Mammal Commission recommendations on needed steps for this sea otter.

U.S. Department of Commerce.

1973. Plastic wastes found on isolated Alaska beaches. United States Department of Commerce News. National Oceanic and Atmospheric Administration 73-74, 2 p.

1978. Environmental impact statement for the renegotiation of the international convention for the high seas fisheries of the North Pacific Ocean. 147 p. Dall's porpoise incidental take in salmon gill nets may be due to a common prey species that attracts both species and inability of the porpoise to detect and avoid gill nets. The huge scale of pelagic gillnetting may also produce problems of lost nets and indiscriminate mortality.

1984. Status report July 1984. 3 p. Special brochure for Channel Islands National Marine Sanctuary on hazards of hook-and-line fishing to the endangered brown pelican, shows how to avoid accidentally hooking pelicans and how to unhook them.

. NOAA Office of Coastal Zone Management. National Marine Sanctuary Program, Program Development Plan.

United States Senate.

1973. Plastic garbage on an Alaska Island. Congressional Record--Senate, 11 April 1973, p. S.7113.

Van Dolah, R. F., V. G. Burrell, Jr., and S. B. West.

1980. The distribution of pelagic tars and plastics in the South Atlantic Bight. Mar. Pollut. Bull. 11:352-356.

Venrick, E. L., T. W. Backman, W. C. Bartram, C. J. Platt, M. S. Thornhill, and R. E. Yates.

1973. Man-made objects on the surface of the central North Pacific Ocean. Nature (Lond.) 241:271.

VNIRO [All-Union Research Institute of Marine Fisheries and Oceanography]

1979. Report on the U.S.S.R. fur seal investigations. Annual report submitted to the 23d Annual Meeting of the Standing Scientific Committee, North Pacific Fur Seal Commission.

1982. Report on the U.S.S.R. fur seal investigations. Annual report submitted to the 25th Annual Meeting of the Standing Scientific Committee, North Pacific Fur Seal Commission.

Waldichuck, M.

1978. Plastics and seals. Mar. Pollut. Bull. 9(8):197. Report on North Pacific fur seals found on Pribilof Islands, dead, entangled in large fragments of unspecified polypropylene net.

Wallace, N.

1984. Entanglement in the marine environment. Whales Etcetera, Connecticut Cetacean Society, Wethersfield, Conn. Vol. 2, p. 11-15.

Waugh, G. T., et al.

1982. Source document for the swordfish management plan. South

Atlantic Fishery Management Council, 135 p. and appendices. This document contains comprehensive and detailed scientific information from which the draft plans were excerpted. Recent use of drift gill nets at night in the northwest Atlantic by a couple of boats is seen as a potential impact on marine mammals and turtles. The gill net fishery is adapted from the California drift gill net fishery, which has existed longer and in greater numbers. There the target species is the thresher shark, but blue and mako sharks are commonly taken. A valuable incidental take of swordfish has emerged, and fishing tactics were adapted to capitalize on swordfish. Some incidental take of soupfin sharks, striped marlin, and sea lions occurs also. Extensive gill net use in the western Pacific for swordfish, striped marlin, and tuna has led to rapid replacement of harpoon gear in Japanese billfisheries.

Wehle, D. H. S., and F. C. Coleman.

1982. Plastics at sea. *Nat. Hist.* 92(2):20-26. Excellent comprehensive review for the lay reader of source, fate, and range of impacts of plastic, mostly debris.

Western Fisheries Magazine.

1983. Japanese netters snare BC (British Columbia) Salmon. An autumn 1983 edition.

White, J.

1972. *National Fisherman Yearbook* issue, No. 58.

Winchell, J. M.

1980. Biological studies on whales entrapped in fishing nets in Newfoundland. First report of the Kolman Fellowship, College of the Atlantic, Bar Harbor, Maine, U.S.A.

Winston, J. E.

1982. Drift plastic--an expanding niche for a marine invertebrate? *Mar. Pollut. Bull.* 13:348-351.

Wong, C. S., D. R. Green, and W. J. Gretney.

1974. Quantitative tar and plastic waste distributions in the Pacific Ocean. *Nature (Lond.)* 247:30-32.

Wong, C. S., et al.

1974. Distribution of tar and other particulate pollutants along the Beaufort Sea coast. Unpubl. manuscript, 69 p. Interim report of Beaufort Sea Project Study C1, December 1974. Beaufort Sea Project, Victoria, British Columbia, Canada.

Yoshida, K., and N. Baba.

1984. The problem of entanglement of fur seals in trawl nets, plastic bands, etc. Submitted to the 28th Annual Meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission, Tokyo, Japan.

Yoshida, K., et al.

1984. Results of studies of trawl nets collected on the breeding island during the breeding season of 1982. Submitted to the 27th Annual Meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission, Apr. 9-13, 1984, Moscow, U.S.S.R.

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